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The Use of Tactical Training Systems in the Evaluation of Command and Control of Major Fleet Exercises

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We will explore the potential to use a fielded Tactical Training Range system to provide real-time TSPI that can serve as "ground-truth" data for the testing of new or improved C^2 systems. Using reliable data of known accuracy and latency, the C^2 T&E community can verify the accuracy and latency of the system under test. Using a system that is already fielded can save the expense of building or purchasing V&V instrumentation suite.

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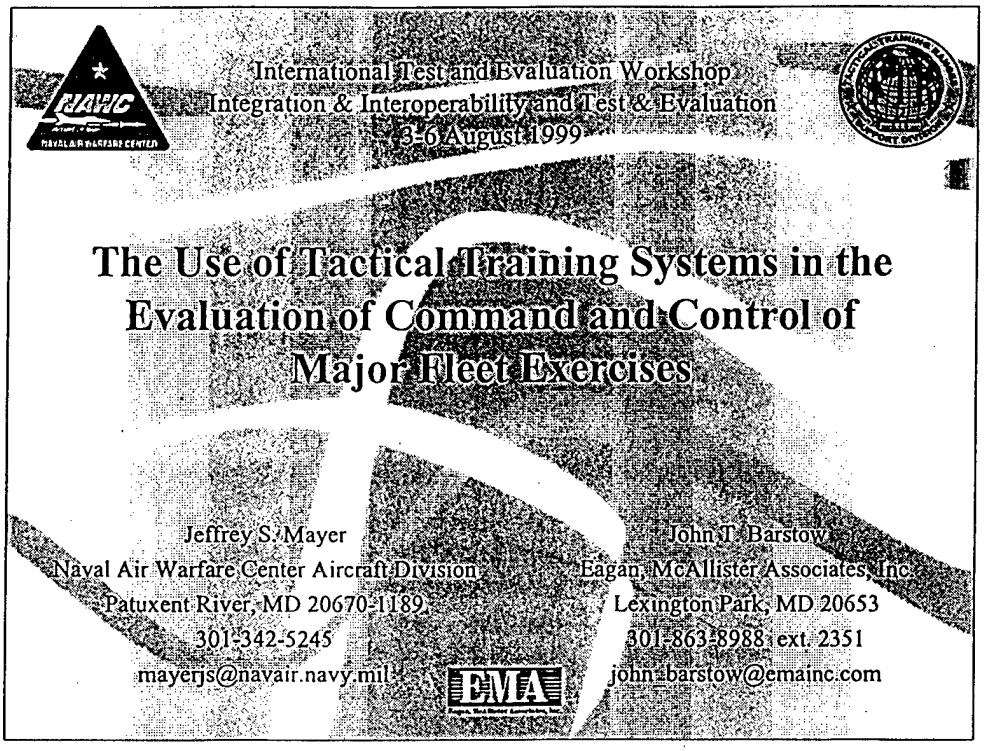
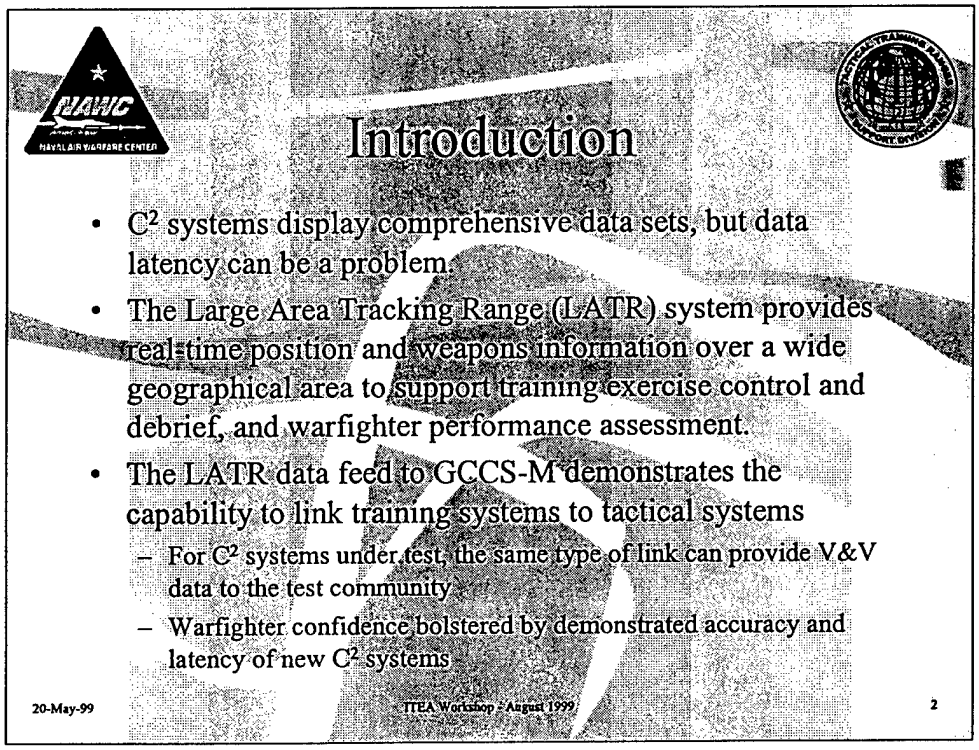


This afternoon we will explore the potential to use a fielded Tactical Training Range system to provide real-time TSPI that can serve as "ground-truth" data for the testing of new or improved C^2 systems. Using reliable data of known accuracy and latency, the C^2 T&E community can verify the accuracy and latency of the system under test. Using a system that is already fielded can save the expense of building or purchasing a separate V&V instrumentation suite.



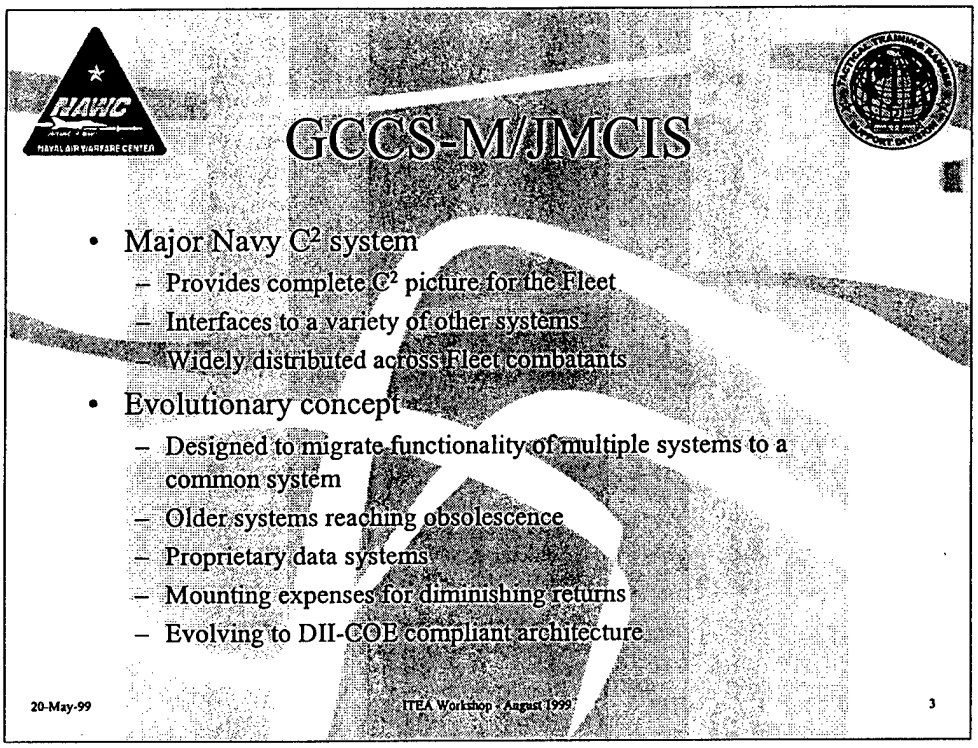
• Command and control systems have come a long way since grease pencils and Plexiglas status boards but in some ways the newer systems suffer from many of the same shortcomings as their predecessors.

• Battlefield situational awareness has always been one of the primary goals of C^2 systems, yet, while our new systems present data in an easy to evaluate format, it is often time late.

• The introduction of the Large Area Tracking Range (LATR) provides the warfighter a Tactical Training Range (TTR) instrumentation system that is capable of presenting a near real-time picture showing accurate tracking, weapons employment, and support data over a sizable geographic area. LATR has demonstrated the ability to track participants over a radius of 500nm with airborne relays.

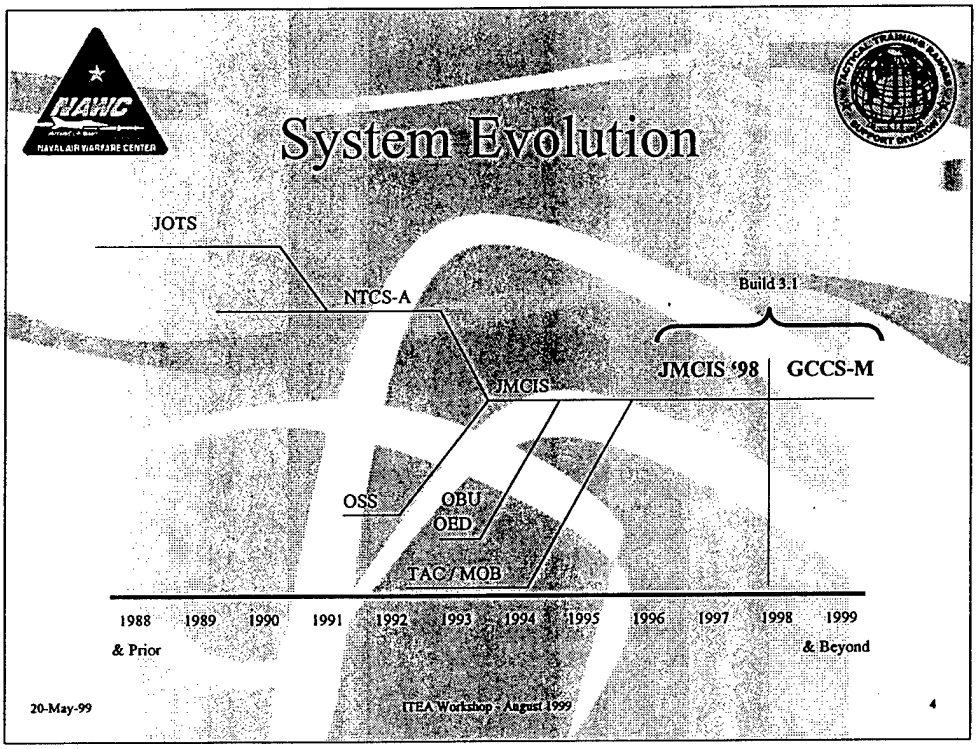
• LATR also includes a data feed to the Joint Maritime Command Information System/Global Command and Control System – Maritime (JMCIS/GCCS-M), providing live, near-real-time Time Space Position Information (TSPI) data for display by an operational Command and Control (C^2) system.

• The merger of this data provides the warfighter with the capability to evaluate C^2 system based tactical decisions against real-time truth data and thus focus on areas that need improvement.



The Global Command and Control System – Maritime (GCCS-M) is the Naval command and control system implemented by the Space and Naval Warfare Systems Command (SPAWARSYSCOM). It provides a complete command and control solution to the Fleet, with interfaces to a variety of communications and computer systems. GCCS-M is currently operational on most surface combatants in the U.S. Navy (carriers, command ships, amphibious ships, cruisers, destroyers, frigates, mine-sweepers, and supply ships). It is used at each of the Fleet Commander in Chief (FLTCINC) command headquarters, located principally within the command centers. GCCS-M is also used by Tactical Support Centers (TSCs) in support of Anti-Submarine Warfare (ASW) and Anti-Surface Warfare (ASUW) pre-mission planning and post-mission analysis. Additionally, GCCS-M is available in several mobile configurations.

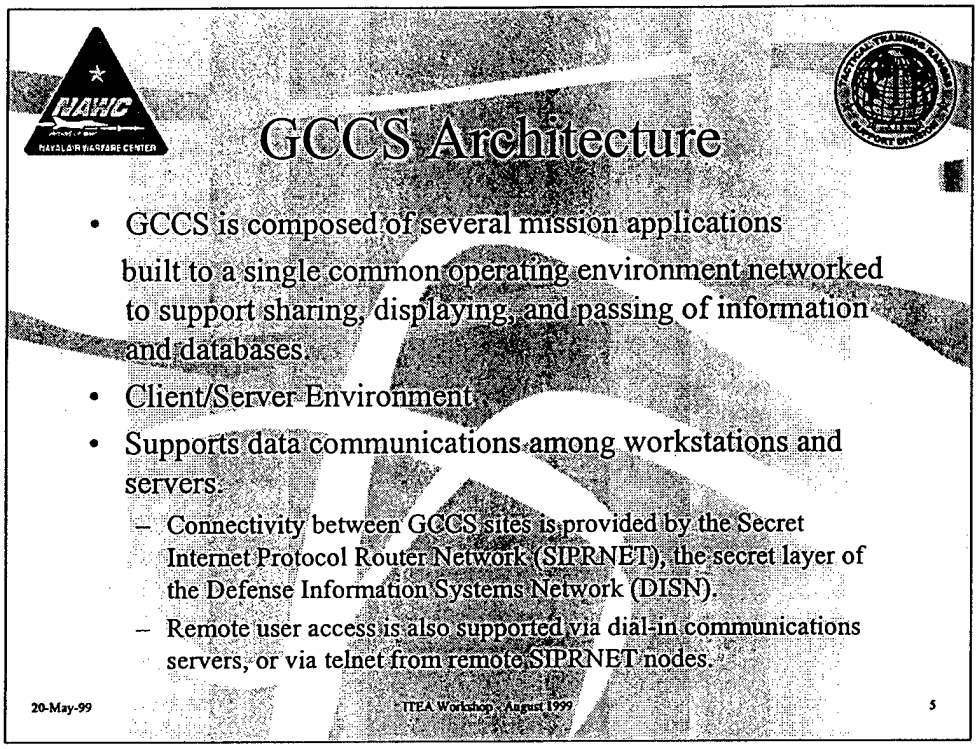
GCCS is a key C4I system in satisfying the C4IFTW concept. It provides a fused picture of the battlespace within a modern C4 system capable of meeting warfighter needs into the 21st century. GCCS incorporates the core planning and assessment tools required by combatant commanders and their subordinate joint force commanders and meets the readiness support requirements of the Services. In moving the joint C^2 support capability into the modern era of client/server architecture using commercial, open systems standards, GCCS brings to the ongoing DOD C4I migration strategy essential tools for the Services and agencies to successfully reduce the large number of systems in use today. GCCS is a user-focused program under the oversight of the Office of the Secretary of Defense ASD(C3I) and the Joint Staff.



• The GCCS-M concept evolved as the product of initiatives that were designed to migrate the functionality of multiple C4I systems to a single system architecture and platform. Each of these C4I systems satisfied a sub-set of the Fleet's C4I needs. In most cases, these systems were nearing the end of their useful life and were becoming very expensive to operate and maintain. Further, because most of these systems were based upon proprietary hardware, operating systems and standards, the exchange of data among these systems was difficult and expensive, generally requiring unique communication interfaces to be developed between such systems.

• The Fleet's needs with respect to a command and control system change over time. The dynamics of these requirements is in response to the continuously evolving geo-political and technological forces that shape not only our world but also the nature of the threat to our national security. With each successive product release new capabilities are added to GCCS-M based upon the Fleet's requirements, and new products and technologies are used, as required, in order to continue to leverage the benefits and cost savings associated with commercial products and standards.

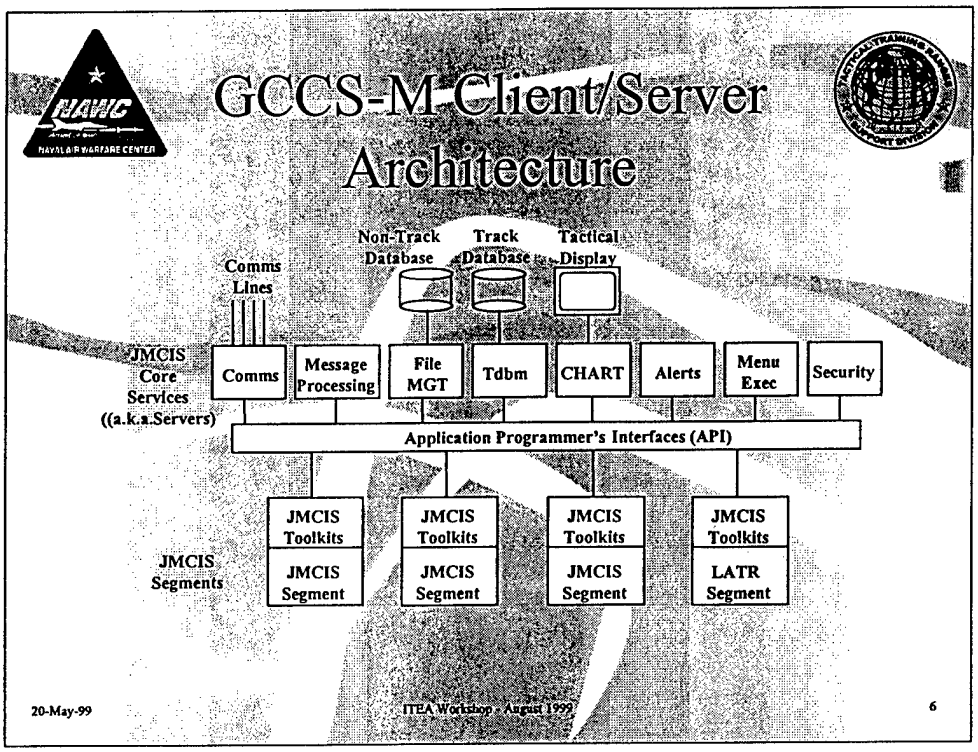
• Much confusion has surfaced about what GCCS-M is and how it differs from JMCIS'98. GCCS-M is the new name for JMCIS'98. GCCS-M is not a new system but the same JMCIS'98 system offering the same functionality. Following Operational Test (OT) in March 1998, JMCIS'98 officially became GCCS-M. This change is but one in a series of system evolutions.



The GCCS infrastructure consists of a client server environment incorporating UNIX-based servers and client terminals as well as personal computer (PC) X-terminal workstations; operating on a standardized local area network (LAN). The baseline GCCS architecture consists of a suite of relational database and application servers.

At most GCCS sites, the relational database server acts as a typical file server by hosting user accounts, user specific data, and site specific files not part of GCCS.

The application servers host the automated message handling system, applications not loaded on the database server and other databases.



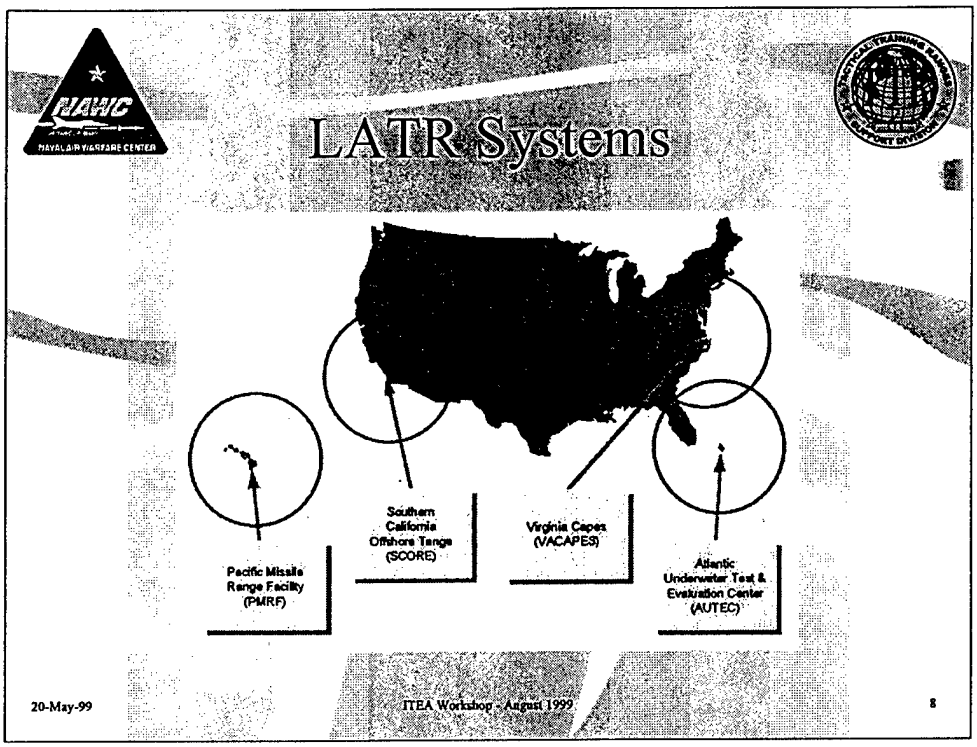
GCCS-M operators use the workstations to perform functions such as contact ambiguity resolution, Officer-in-Tactical Command Information Exchange Subsystem (OTCIXS) network administration, Force Over-The Horizon (OTH) Track Coordinator (FOTC) database quality assurance, and corrections to erroneous incoming messages. The client workstations typically contain mission-oriented client applications and server applications. The client applications can use the resident server applications to connect to master server applications residing on master workstations. Comms and TDBM server applications on the client machine establish a connection to the master Comms/TDBM server and behave as clients to the master, requesting services and information from the master server. With this approach, application software does not need to concern itself with whether it is operating on a master or a client (also known as slave) workstation. The application software establishes a connection with the server residing on its workstation, which may in turn establish a connection with the master residing on another workstation.

This architecture permits an authorized operator to access all required functionality from any workstation, regardless of the workstation's location relative to where the actual processing takes place. This distributed processing, coupled with behavior specifications for GCCS-M-compliant segments (modular applications providing specialized software functionality), allows GCCS-M to present a consistent interface to every operator, while restricting functionality to only those functional units which are needed for each operator's task.

• The Large Area Tracking Range is a Tactical Training Range instrumentation system that provides an integrated, offshore, Over-The-Horizon (OTH), Time-Space-Position-Information (TSPI) capability to support tactical training exercises conducted in the coastal areas of the United States. LATR will support tactical training scenarios from single platform, unit level exercises through complex, integrated multi-warfare area, multi-platform battle group level exercises. Additionally, LATR will support multiple simultaneous independent training exercises.

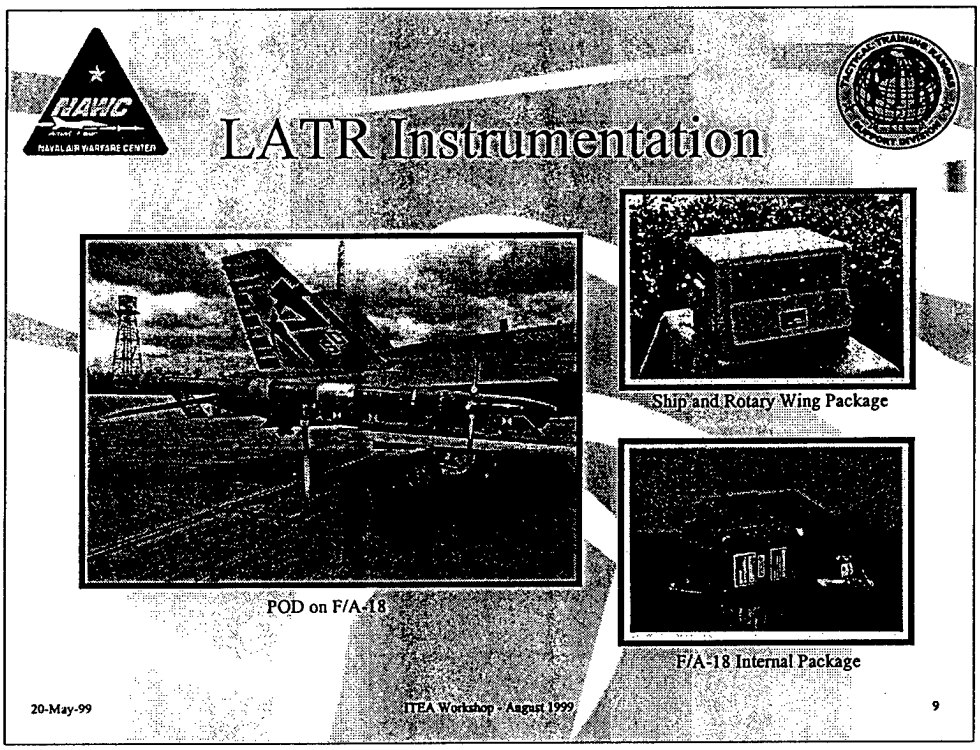
• LATR consists of two major subsystems: the LATR Computer and Debrief System (LCDS) and the LATR Tracking System (LTS). The LTS uses Participant Instrumentation Packages (PIPs) on ships and aircraft to provide tracking information for a mix of up to 124 instrumented participants. The LTS uses the Global Positioning System (GPS) to provide accurate Time Space Position Information (TSPI) data. The LTS also provides a means to access fixed-wing participant weapon system data and to relay data between the participants and ground receiver sites using AN/URY-3 Relay, Reporter, Responder (R^3) units. The relay capability of the PIPs allows tracking of participants out to 500nm from the Ground Interrogation Station (GIS). PIPs have been developed for fixed and rotary wing aircraft, and surface ships.

• The LCDS receives GPS tracking information and weapon system data from the LTS and other range sensors and processes the information for evaluation and display. Data are displayed in real time at the LATR range operations center for exercise control. Debrief data can be processed and ready for distribution to remote LATR Debrief and Training Systems (LDTS), or to surface ship or shore-based participants within one hour following an exercise. LATR can provide training exercise data in real-time to the command ship of each exercise. Following completion of the exercise(s), selected exercise data can be transmitted to the surface participants for replay, to support training aboard ships. Exercise data can also be retransmitted to land-based remote sites for reconstruction and debrief purposes.



• LATR systems have been installed at the Southern California Offshore Range (SCORE) in San Diego, the Pacific Missile Range Facility (PMRF) in Hawaii, the Virginia Capes (VACAPES) facility in Virginia Beach, Virginia, and the Atlantic Undersea Test and Evaluation Center (AUTEC) at Andros Island in the Bahamas.

• LATR is designed to interface with the host range infrastructure. It accepts data from a variety of range sources, such as surveillance radars and NTADS. LATR's ability to display data from a number of sources makes it ideal as a consolidated display system, much the same way a C^2 system provides fused data from a variety of information sources. In an ongoing software evolution, LATR Version 2 software incorporate track data form the Tactical Aircrew Combat Training System (TACTS), a multi-lateration training range instrumentation system. The TACTS tracking information, once imported into LATR, is managed like other LATR track information and can be forwarded to remote sites for monitor or debrief purposes. LATR Version 3 software adds the capability to better display detailed air combat maneuvering (ACM) engagements between opposing force aircraft during training exercises.



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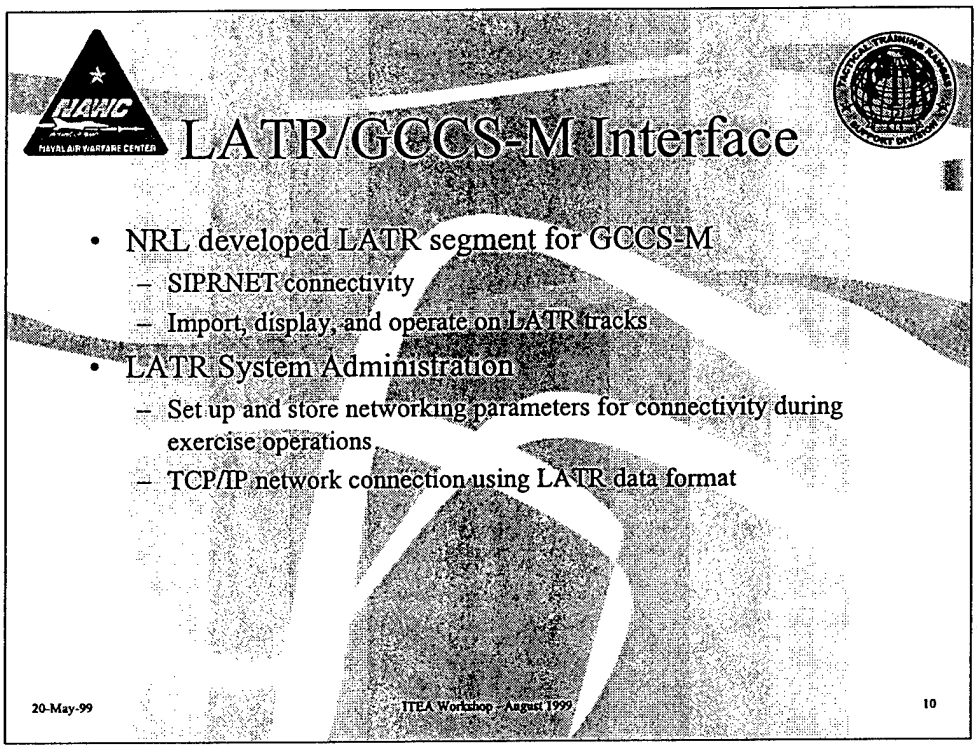
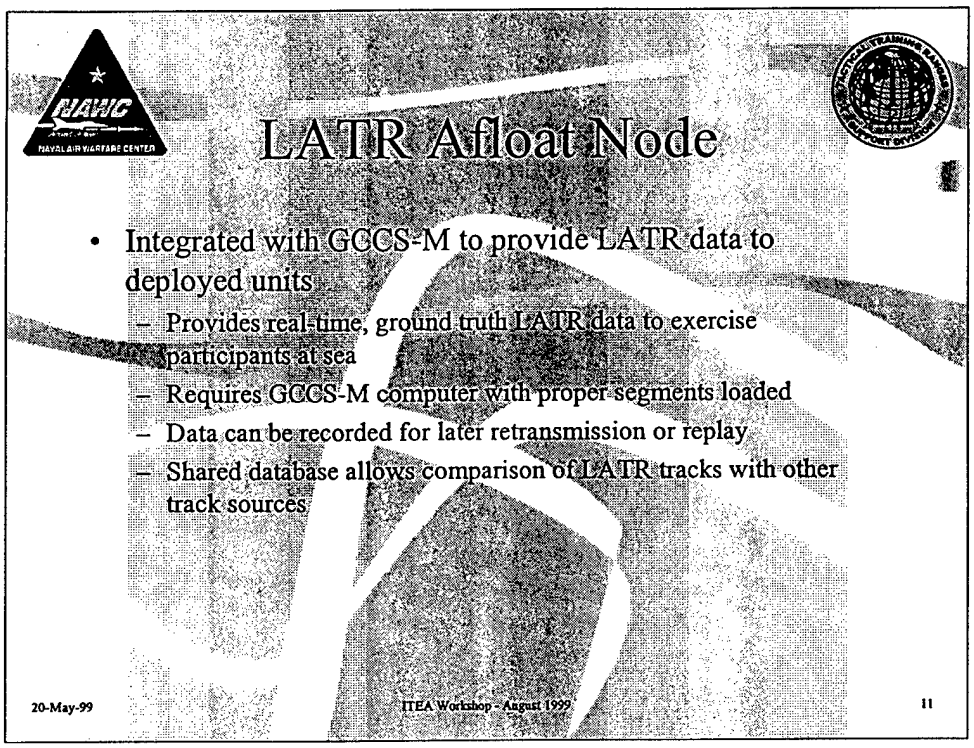


• The Naval Research Laboratory (NRL) has developed two LATR segments for GCCS-M. Any site or unit equipped with a GCCS-M configured computer, the appropriate GCCS-M segments, and connectivity to SIPRNET can import, display, and operate on LATR tracks much like a LATR remote site, thus providing an additional avenue to proliferate remote sites for mission monitoring, analysis, replay, and debrief.

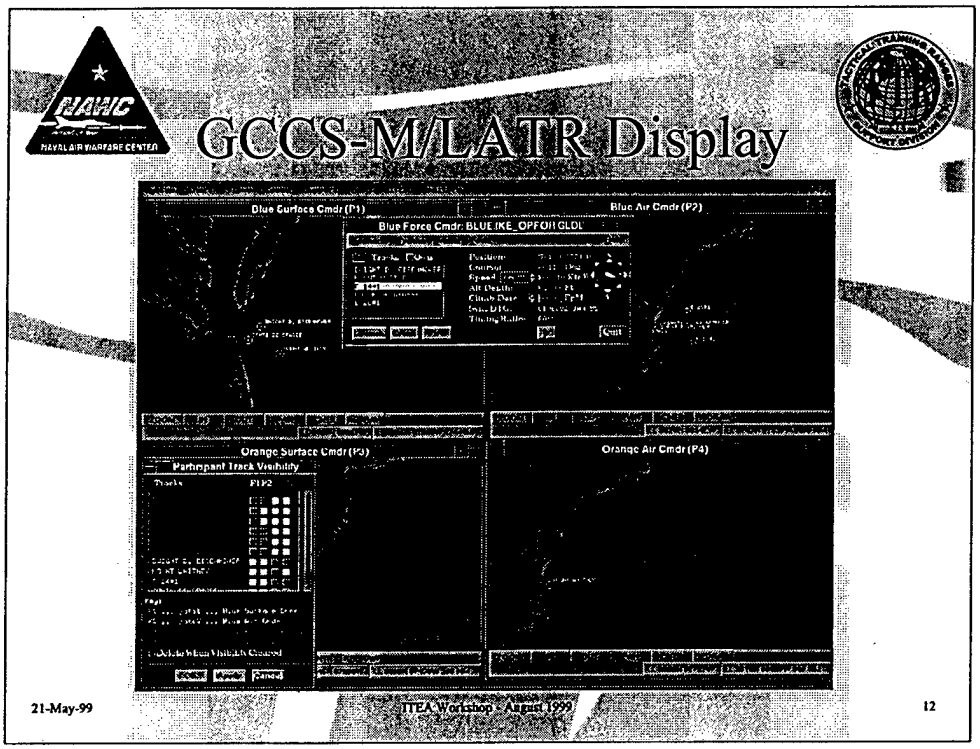
• The LATR System Administration (LATRSA) module allows the System Administrator (SysAdm) to set up the networking parameters necessary for the LATR user to connect to the LATR host range ashore via SIPRNET, INMARSAT, or STU-III. Only the SysAdm is allowed to change, save and delete the LATR networking parameter files, although the LATR user can choose from a set of parameter files previously saved. All the LATR data is sent over the selected TCP/IP network connection, in a LATR specific format.



• The LATR-Afloat Segment is integrated within GCCS-M to provide the afloat node of the Large Area Tracking Ranges (LATR). The LATRs are heavily instrumented to provide precision tracking of platforms on the range. The data gathered by LATR provides actual platform positions ("ground truth") for comparison with positions reported by the platforms. The LATR-Afloat segment allows shipboard users, or others, to receive LATR data, convert it to a GCCS-M format, and display it on a GCCS-M terminal. The LATR tracks can be shown in a separate map window for side-by-side comparison or they can be overlaid on the display of GCCS-M tracks.

• Communications with LATR System software ashore is accomplished primarily via SIPRNET due to its wide availability and common use for other classified tactical communications. The user may optionally choose to receive data from a live exercise, or select a previously archived exercise for transfer to the platform and subsequent replay as part of a post-exercise debrief. Live data also may be recorded at the ship/site for later replay. LATR tracks appear on the GCCS-M display as Simulated Terminal Tracks and may be viewed and manipulated separately from the GCCS-M Real-World tracks. The use of Simulated Terminal Tracks for LATR data enables GCCS-M core software and optional Tactical Decision Aids to recognize and use the LATR data for analysis without going to an off-line status.

• The GCCS-M workstation may continue to receive, process and display organic and non-organic Real-World data while viewing LATR data. LATR-Afloat has user selectable filters that allow data to be tailored to the users' needs. Specific missions within exercises may be selected for transfer from the Range and data sampling of live data. Reconstructed LATR data can be replayed in real-time (1:1), at any compressed ratio up to 999:1, or at computer processing speed.



Multiple window capability along with the the ability to merge LATR data with GCCS Track Database information allows Fleet Commanders to evaluate the accuracy of their C^2 Systems.

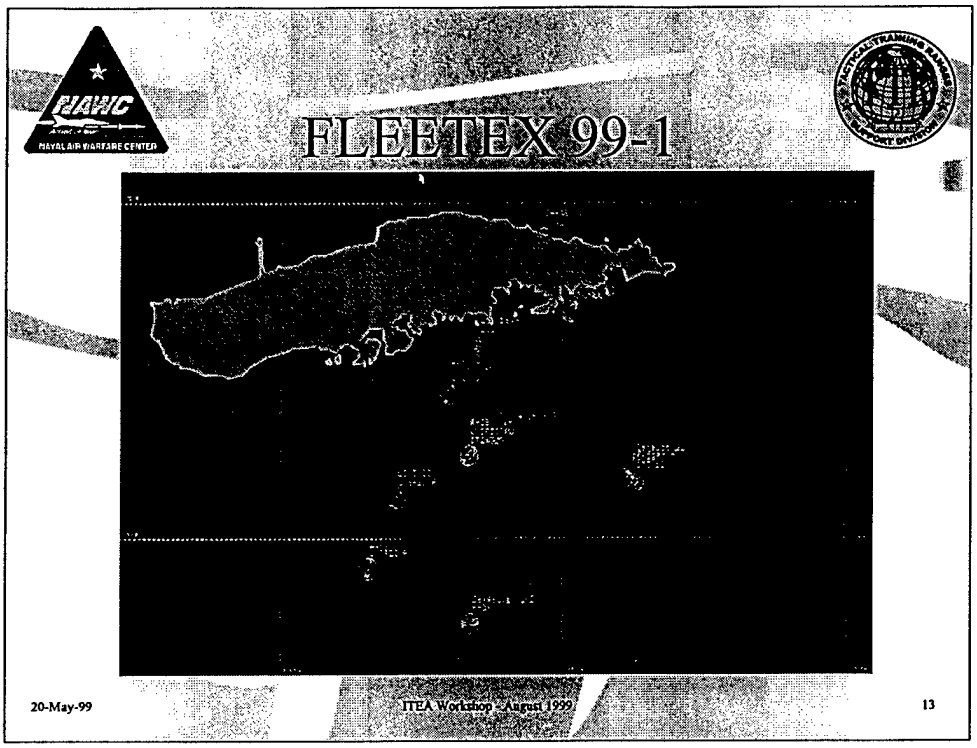
Was the target where I thought it was?

Did my commanders interpret the available data correctly?

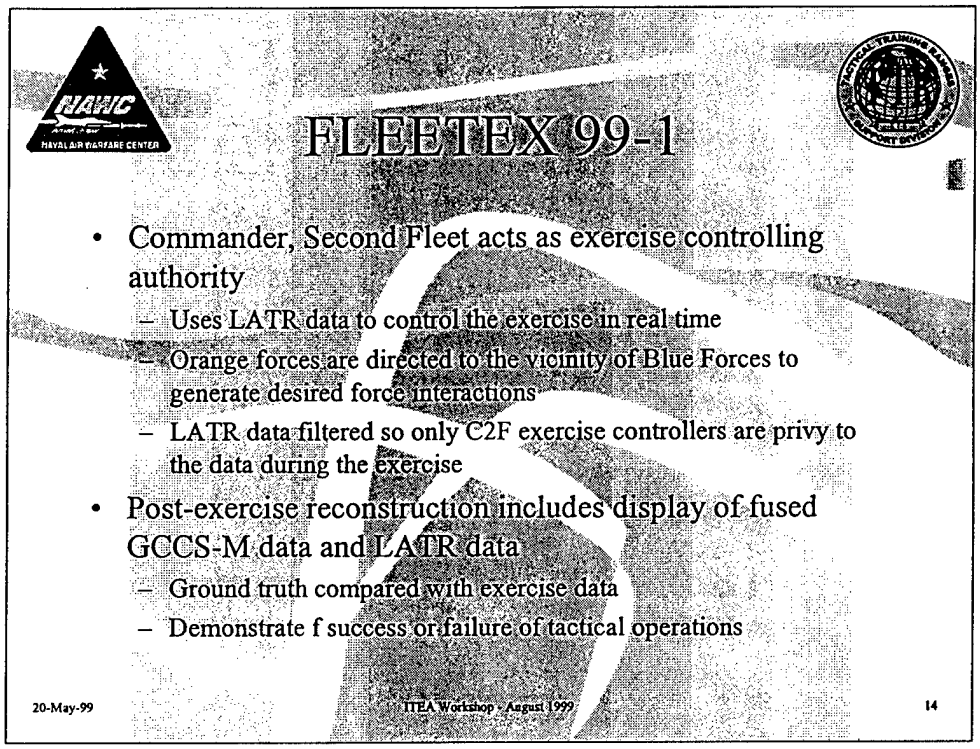
Is the data timely?

What sources provide the best data?

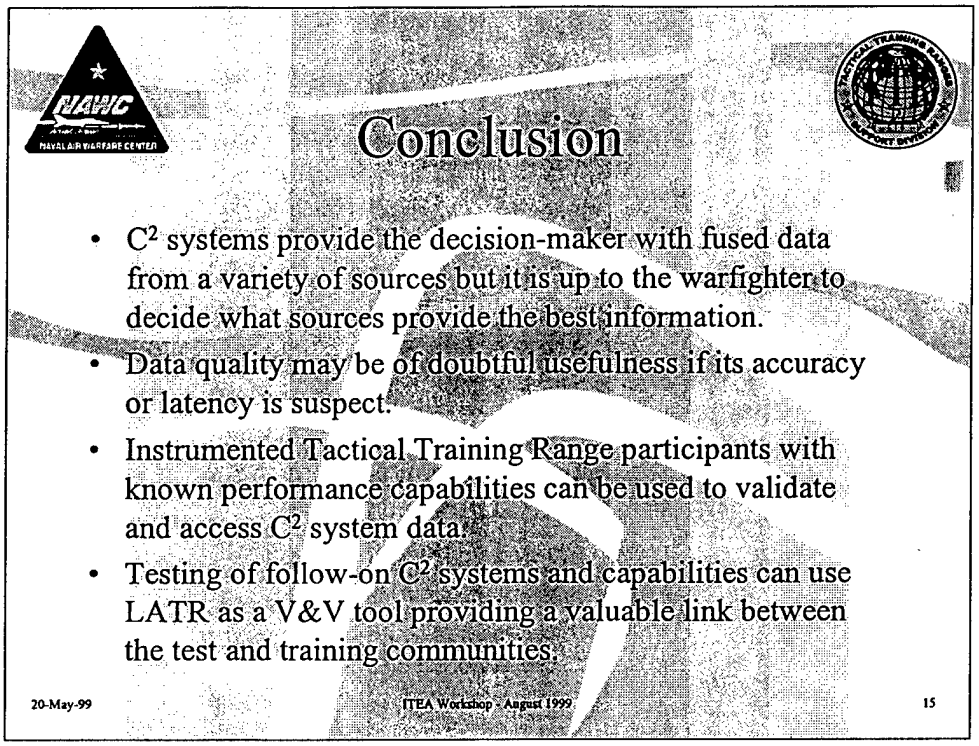
In addition the Commander of Orange forces, which often has no intel or major assets can use the data to direct his forces efficiently.



Fleet Exercise (FLEETEX) 99-1 demonstrated the use of LATR in a long-range C^2 training environment. LATR-instrumented participants were tracked during their transit to the Puerto Rican Operating Area (PROA). A LATR Transportable Ground Interrogation Station (TGIS) was positioned at the Atlantic Fleet Weapons Training Facility (AFWTF) in Puerto Rico. The TGIS tracked participants in the PROA during a live Supporting Arms Control Exercise (SACEX) and transmitted the data back to the Fleet Area Control and Surveillance Facility – Virginia Capes (FACSFAC VACAPES) at NAS Oceana, VA for display. The LATR data was then forwarded to the JMCIS/GCCS-M system for display with other C^2 data on board the JMCIS-equipped ships participating in the exercise.



Commander, Second Fleet (C2F), as the FLEETEX controlling authority, uses LATR data as a method to control the flow of the exercise while it is in progress and as a means to analyze and critique the performance of the units that participate in the exercises. C2F monitors LATR track data in real-time in order to direct opposition (Orange) force interactions with the exercise (Blue) forces. This allows C2F to ensure that the planned force interactions take place in a timely manner in order to maximize training opportunities throughout the exercise time period. LATR ground-truth information can be filtered so that only the C2F exercise controllers are privy to this data. During exercise reconstruction, actual unit positions can be compared with unit positions reported through GCCS-M, providing a valuable tool for showing exercise participants why particular operations succeeded or failed. Having actual track data also eliminates the need for manual tracking of exercise participants and speeds the data reconstruction process considerably.



C² systems provide the decision-maker with fused data from many sources. Since the data can vary in their degree of accuracy, latency, and reliability, the decision-maker cannot always be certain that a particular datum is of the same quality as any other datum. TTR instrumentation systems provide a means to track individual participants with known accuracy, providing "ground truth" TSPI and weapon event data for those participants. Integration of the TTR instrumentation system data with the C² system data provides a powerful tool for evaluating the performance of the C² system under known conditions. During a training exercise, the force commander uses the C² data available to him to make tactical decisions. While the exercise is in progress the evaluation team can fuse the C² system data with the TTR instrumentation system "ground truth" data, generating a single display with both data sources shown simultaneously. At the conclusion of the exercise, the evaluation team can show the force commander the fused data display, highlighting the differences between participant positions as predicted by the C² system and as recorded by the TTR instrumentation system. These differences demonstrate to the force commander why particular tactical decisions were effective or ineffective, depending on the accuracy of the C² data used in the decision making process. For example, the force commander makes decisions based on the real-world data provided to him through JMCIS/GCCS-M. This data can then be compared directly to LATR "ground truth" instrumentation data. Comparison of the differences between the tactical pictures portrayed by these two systems allows the force commander to evaluate the usefulness of the various C² data sources available to him for tactical decision making. LATR's integration with other systems, such as the Tactical Aircrew Combat Training System (TACTS) and air surveillance radars, makes it a significant contributor of C² information at the exercise control level. The TACTS and surveillance radar data fed to LATR show non-LATR-instrumented exercise participants as LATR tracks on the LATR display, expanding the number of exercise participants that are shown on a single, integrated training system display. The LATR data feed to JMCIS/GCCS-M then displays all LATR tracks, regardless of source, on the C² displays in near real time along with other C² information, allowing side-by-side comparison of the fused picture to evaluate the data available to the force commander.

Use of live, real-time TTR instrumentation systems provides a means to verify the accuracy, reliability, and timeliness of a C² system under test or training conditions. Integration of an available training system that possesses known accuracy and latency provides an additional tool to the T&E and training communities for the evaluation of new C² systems and their capabilities.